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ABSTRACT

This pamphlet discusses student learning styles and teachers' adaptability to those styles. Section 1 discusses "What Are Learning Styles" by talking generally about cognitive, affective, and physiological aspects of those styles. Section 2's topic is "What Determines Learning Style?". "The Relationship Between Learning Styles and Teaching Styles" composes the third section, and an Informal Learning Style Inventory is included for the teacher. Section 4 discusses the "Implications of Brain Research for Learning Style Development"; included is a list of four instructional implications for learning style development. The subject of part 5 is "Adapting Teaching Style to the Learning Situation"; included are 10 suggestions for teaching strategies that recognize the varieties of learning styles. "Ways to Assess Learning Styles" are discussed in section 6, and a selected bibliography of learning style assessment instruments is included. Section 7 discusses "Matching Teaching Styles with Learning Styles," and section 8 talks about "Learning to Style-Flex" and includes 29 style-flex strategies. A bibliography is included. (JM)

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What You Should Know About Teaching and Learning Styles

Claudia E. Cornett

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What You Should Know About Teaching and Learning Styles

By Claudia E. Cornett

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Introduction

How people learn is of interest not only to educators but to everyone. The young and the old, the rich and the poor, scholar and laborer alike—all would like to be able to read faster, remember more, think more logically, and perform more creatively. Perhaps this interest in how we learn stems from the realization that the human being's capacity for learning is what distinguishes us from other living creatures. While each of us possesses unique ways of learning that are woven inextricably into the fabric of our personalities, we also share many learning similarities. Knowing these similarities enables educators to structure general learning experiences in the curriculum. But each student will approach these general learning experiences in a personal, individualized way.

Interest in how people learn is not a new concern. Philosophers of ancient Greece and Rome formulated ideas about learning that were to influence educators for centuries. Aristotle's mnemonic techniques of association and visual imagery are still in use today; and the Greeks' classification of temperaments into sanguine, choleric, melancholic, and phlegmatic foreshadowed much of the work on personality types done during the past 50 years. But memory and personality types are just two topics on a long list of items that deal with aspects of learning. Over the years we have begun to realize that the more we learn about learning, the more we really need to know. Unlocking the secrets about learning is like opening a puzzle box, only to find another box and then another. Each step, each piece of information, leads us closer to understanding how we develop that wholeness of person, which brings the intellectual, emotional, physical, and spiritual aspects of learning into harmony—the long-held goal of liberal arts advocates.

In the late 19th century, Charles W. Eliot, president of Harvard University, called for individualization in order to make the college curriculum a truly liberal education; and his voice only echoed those of Pestalozzi, Rousseau, Comenius, and many other educators who had recognized the need to examine and to develop the uniqueness of each person. It is on this sturdy historical foundation that contemporary models of teaching and learning have evolved.

It is an exciting time to be an educator. Never before have we known so much about the central organ of learning—the brain in all its complexity. In the last decade we have witnessed an explosion of new information about the brain, resulting in fascinating theories, some supporting and others refuting what we have long thought or intuited about how we learn. It is tempting to adopt a “wait and see” attitude toward such theories as hemispheric brain functioning; but if we wait until such theories are thoroughly substantiated, thousands of children will pass in and out of our classrooms. Therefore, it behooves us as educators to implement those ideas and theories that we think have a reasonable chance of success, given our past teaching experience and the new, albeit incomplete, knowledge available to us.

The task will necessitate a multidisciplinary perspective, using the insights of psychologists, neuroscientists, linguists, anthropologists, and fellow educators. Such a perspective will allow us to avoid the pitfalls of one-dimensional views of learning, e.g., behaviorism. As S. Kramer warns, “nothing is as inimical to the truth as the conviction that one has already found it.”

As educators, our challenge is to draw classroom implications from all available sources in order to help students become better learners. The search for better solutions to teaching and learning is what drew most of us into pedagogy; and it is the excitement of the search that keeps us there.

In this fastback I shall review the recent thinking and research on teaching and learning styles and attempt to show their relationship to classroom practice. Because I cannot synthesize the vast body of literature on teaching and learning styles in the limited space of a fastback, those readers who want to pursue the topic in greater depth are encouraged to use the extensive bibliography provided.

What Are Learning Styles?

Anyone surveying recent professional journals in education would likely conclude that it seems to be "in style" to talk about learning styles and their effects on the learning process. But educators may feel overwhelmed with the many labels or categories used to describe the different areas of style. (One instrument for identifying learning styles has more than 300 items!) Essentially, learning style can be defined as a consistent pattern of behavior but with a certain range of individual variability. When persons learn they use learning styles that are uniquely their own, but make moment-by-moment style adjustments, depending on the nature of the task and the teaching style being used. Styles then are overall patterns that give general direction to learning behavior. But rather than simply looking at learning styles in isolation, educators need to understand styles as they are manifested in the classroom, interacting and influencing one another in an infinite number of ways.

Learning Styles—Cognitive, Affective, Physiological

When discussing learning styles, it is helpful to distinguish their cognitive, affective, and physiological aspects. The *cognitive aspect* includes the ways we decode, encode, process, store, and retrieve information. Do we do it by focusing or scanning, randomly or sequentially, concretely or abstractly? Each of these pairs of types of cognitive processes represents ends on a continuum. Individuals usually fall somewhere along the line between the two poles but have the capacity for using each operation to some degree. Much of a person's cognitive learning style can be related to hemispheric brain functioning with the processes falling to either the right or left hemisphere.

An individual's capacity for using some of each type of cognitive process can be explained by the corpus callosum, the information-sharing mechanism between the brain hemispheres. So, while a learner

may initially approach a problem randomly (right hemisphere), the nature of the task may demand sequential processing (left hemisphere). Given time and direct instruction, the learner can probably switch orientations.

But learners whose cognitive orientations tend to lie consistently at extremes on the continuums will have to have more teacher mediation when the task or problem is at odds with their predominant cognitive tendencies. The nature of the mediation will depend on the task and the learner; for example, the teacher may need to paraphrase, to ask more questions, to give more explicit directions, to set up different time limits, to provide alternative materials, etc.

Obviously, the more the teacher knows about the child's learning style, the more likely it is that the mediation will be effective. The same would be true with regard to the task, since each task places certain cognitive demands on the learner. These demands would need to be identified by the teacher before he or she could mediate the learner's cognitive style and the task's cognitive demands. For example, a cognitive task demand in the social studies is for the learner to comprehend the thinking patterns the textbook authors use in writing each paragraph. Authors assume the reader can think in these patterns when reconstructing their messages (e.g., understanding the causes and effects of the Civil War). The learner not only must read the information, but also must organize it based on the thinking pattern of the author (cause and effect). The success learners have with this task will depend on their own innate style and on acquired thinking patterns that enable them to construct meaning. Learners who do not have a command of necessary thinking skills need to be taught them, drawing upon such resources as Bloom's taxonomy.

Affective aspects of learning style include emotional and personality characteristics related to such areas as motivation, attention, locus of control, interests, willingness to take risk, persistence, responsibility, and sociability. Knowledge of this aspect of learning style can help educators understand why praise and external reinforcement have a positive effect on some learners but a negative effect on others. Some need extrinsic rewards, while others find intrinsic reinforcement in the task itself. Another affective aspect is the type of groups or people with

which a person learns best, given particular tasks. For example, a personal mentor for each student may work best if the task is learning how to write a computer program, but a brainstorming group comprised of peers may work best if the task is to plan a field trip to the airport.

The *physiological aspects* of learning style include sensory perception (visual, auditory, kinesthetic, taste, and smell), environmental characteristics (noise level, light, temperature, room arrangement), need for food during study, and times of day for optimum learning. Kenneth and Rita Dunn have devoted considerable attention to the environmental aspects of learning style. Walter Barbe and Raymond Swassing, among others, have contributed much to our understanding of the perceptual elements of learning style. For example, a lecturer can help the visual learner by using a visual outline of the talk; this same visual outline probably will help the auditory learner since it provides structure for listening.

Although there is a large body of research pertaining to preferred sensory modes and environmental elements of learning style, they can be overemphasized. As an old aphorism puts it, "What is essential is invisible to the eye." Equally important is an individual's purpose or intention in the processing of stimuli. For example, while viewing a painting (visual, non-verbal, right-brain functions), it is quite possible that in the processing of the picture we might generate words to describe it and end up "understanding" the picture through verbal, logical, left-brain functions. Or we might process a lecture in a right-brain manner by generating visual images related to the content of the lecture and by responding emotionally to those images. In studying learning styles, we must search for all the pieces and not necessarily assign each piece equal value. We must avoid the temptation to concentrate on what is easiest to understand while ignoring the more complex elements that have the greatest potential for stimulating deeper learning. M.C. Wittrock makes the point well when he states:

... instruction cannot be thoroughly understood by attending to the apparent qualities of treatments . . . mental transformations performed by different people determine whether instruction is rote or meaningful, whether it stimulates verbal or spatial processes, and whether it facilitates learning and memory.

What Determines Learning Style?

Learning style seems to be a combination of nature and nurture. While learning style has been defined as a consistent pattern of behavior, it does change with age and experience. For example, with maturation cognitive style tends to move in the direction of greater abstraction and field independence. This developmental trend, however, tends to be confined to technical societies like the United States, which seems to give credence to the effects of so-called left-brain oriented curricula (Fox, 1979). American children from Mexican backgrounds and American Indians do not necessarily show this same developmental pattern. Such researchers as Manuel Ramirez and Alfredo Castaneda and others have found that American Indians educated in their own culture tend to become more field dependent, just the opposite of their Anglo neighbors. So, while the learning style blueprint is initially based on inheritance and prenatal influences, a person's learning predisposition is subject to qualitative changes resulting from maturation and environmental stimuli.

The research of Jean Piaget and Lawrence Kohlberg has identified discrete stages of cognitive development that are influenced by peers, parents, or teachers using cognitive processes not presently in a child's repertoire, but within reach developmentally. In particular, Kohlberg maintains that exposure to higher levels of cognitive functioning is critical to a child's growth in moral reasoning.

Concern about learning style need not be confined to children. Throughout life, all people are subject to changes within a relatively stable overall style structure. Patricia Kirby calls these "process"

changes within the cognitive "structure" and notes that, even with such changes, there would be more variation among an individual's learning styles (interstyle differences) than could be found at different points in a person's life (intrastyle differences).

Teachers can influence style changes in students by modeling many styles themselves. Kohlberg calls for the use of an appropriate level of dissonance or tension to stimulate cognitive development. By using probing questions at appropriate times or by using examples that provide alternative perspectives, teachers can supply such stimulation. Frequent use of "Why?" questions requires children to "stretch" to support their thinking. Through carefully worded questions, teachers can assess students' present cognitive processes and then stimulate each student with appropriate follow-up questions. Two effective general methods for initiating discussion are the question, What did you learn? and the request, Tell about what you read. Both allow students to use their preferred cognitive and affective style modes, which creates a feeling of success without focusing on right answers. There is, however, focus on *appropriate* answers, given the previous learning experiences. Teachers can subsequently probe with more specific questions to bring out main ideas, key concepts, or whatever is critical to comprehension and understanding. During this process, the teacher may also use the soliloquy, or "thinking aloud," procedure to demonstrate for the children how to think in a certain way, e.g., how to generate visual images from reading materials.

The Relationship Between Learning Styles and Teaching Styles

Every teacher has a learning style. It is likely that the teacher's learning style will have a greater variation than that of the students because the teacher has had many more experiences. But, whatever the teacher's learning style, it will have an effect on his or her teaching style. In a nutshell, we tend to teach the way we learn, unless there is a conscious reason to do otherwise, e.g., to mediate for a learner who cannot learn in the teacher's basic style or one who has a style that is not compatible with the task demands.

Since learning style seems to influence teaching style, does teaching style influence learning style? While this writer found no studies that answered this question, there is support for the modification of students' cognitive styles in accordance with the cognitive style used by the teacher (see Kuchinskas and Coop and Sigel in bibliography).

It is interesting to note that teachers tend to choose areas of teaching based on their personal learning proclivities. For example, abstract, sequential, analytical learners tend to choose to teach math and science. Herman Witkin reported that elementary teachers had a tendency to be field dependent, meaning they were socially oriented, took cues from other people as to appropriate behavior, were more responsive to diverse points of view, and needed more clearly defined goals. In contrast, secondary teachers of math and science tended to be field independent, that is more independent in their decision making, were relatively impersonal, and more intrinsically motivated.

Although there is a good deal of disagreement as to what constitutes learning style, nearly all style enthusiasts would agree that everyone needs to know his or her style, realizing that it will change over time and even during daily interactions. Consider how differently you would give directions to the nearest hospital if asked by: a) a man with a pregnant wife in the car, b) an inebriated adolescent, and c) a person who speaks very little English. The goal is to have both teachers and students become knowledgeable about their styles so they can consciously adjust,

adapt, or modify them in order to increase learning. The first step in reaching this goal is to make a personal assessment of your own learning and teaching style.

The following learning style inventory is an informal, self-administered instrument that can give you a rough indication of your learning and teaching style. The instrument covers the cognitive, affective, and physical aspects of learning styles discussed earlier. More formal assessment instruments available from various publishers are listed on pages 32-37.

After completing this inventory, perhaps you will discover things about your learning and teaching style that you had not realized before. If your cognitive profile lies more to the left, then you probably are more left-brain oriented; if it lies to the right, then you are likely to be more right-brain oriented. If your affective profile lies to the left, you are probably more systematic, structured, and organized. If your affective profile is more to the right, you are probably more flexible, group-oriented, and creative. Perhaps you will discover a balance of right and left. What is important is to "know thyself." But remember, this is only a rough indicator!

Informal Learning Style Inventory

- Directions:**
1. For the sections dealing with cognitive and affective styles, put an X on the line at a point where you think you fall with regard to the polar concepts expressed by the two words. For the section dealing with physical aspects of learning style, check your preferences and describe the environment in which you learn best.
 2. After completing the inventory draw a line connecting the X's. This, along with your preferences, will give you a rough profile of your learning and teaching style.

Cognitive Style (concerned with processing, encoding, storage and retrieval of information)

sequential random

serial simultaneous

focusing	scanning
separating	integrating
parts	whole
discriminate	generalize
sharpening	leveling
abstract	concrete
compartmentalization	differentiation
narrow categories	broad categories
analyze by describing	draw relationships based on functions and themes
reflective	impulsive
deductive	inductive
convergent	divergent
analytic	global
splitter	lumper
logical	metaphoric
words	images
time-oriented	non-temporal
digital	spatial
details and facts	generalizations
careful	quick
literal	figurative
outline	summarize
surface approach	deep approach
memorize	associate/understand

verbal communication non-verbal communication
 implications analogies

Affective Style (concerned with attention, motivation and personality)

objective subjective
 practical theoretical
 reality fantasy
 subject-oriented people-oriented
 realistic imaginative
 intellectual creative
 close-minded open-minded
 conformist individualist
 concentration distraction
 reserved outgoing
 thinker intuiter
 rigid flexible
 Groucho humor (puns, satire) Harpo humor (slapstick)
 competitive cooperative
 structured unstructured
 intrinsically motivated extrinsically motivated
 persistent gives up easily
 cautious risk-taking
 intolerant of ambiguity tolerant of ambiguity
 internal locus of control external locus of control
 leader follower

pessimistic optimistic
 future-oriented present-oriented
 does not like pressures likes pressure
 likes working alone likes working in a group

Physical Style (concerned with perceptual modes, energy level, time preferences and environment)

Directions: Check your preferences.

<i>Receiving Information</i>	<i>Expressing Yourself</i>
visual (reading and viewing) _____	visual (writing, drawing, etc.) _____
auditory (listening) _____	oral (speaking) _____
kinesthetic (feeling and doing) _____	kinesthetic (art, demonstrating, or showing) _____
smell _____	
taste _____	

Describe the environment in which you learn best (lighting, furniture, room arrangement, noise level, time of day, etc.).

The more teachers know about their teaching and learning styles, the easier it will be for them to see specific ways their styles can be amplified or modified. For example, if teachers know that they are visual-kinesthetic *learners* who tend to process information in a global way, often oversimplifying and ignoring details, are intrinsically motivated, work best in the morning and favor right-brain activities like art, drama, and literature, then they should take these factors into consideration when evaluating their *teaching* styles. If, as might be expected, these teachers teach by using a lot of transparencies, writing on the chalkboard a great deal, focusing discussions and reading on finding the main ideas and themes, expecting children to find schoolwork intrinsically enjoyable, setting a fast pace in morning classroom activities, using art and drama when teaching reading, and slowing down after lunch, when they schedule their least favorite subject, math, then they have some specifics about their *teaching* styles that could be critical factors in relation to their students' learning styles. The more teachers learn about their own teaching and learning styles the more they can explain what happens in their classrooms and why. By making explicit their teaching and learning styles, the teachers have taken the first step toward realizing that not all of their students learn as they do; and perhaps problems some children are having result from a mismatch between their teaching styles and students' learning styles.

Once teachers gain an appreciation of the variety of learning styles, they can respect learning style differences and adapt their teaching styles for different situations. They may also be alert to situations in which students' learning styles limit their success in academic areas. For example, with strongly right-brain learners who may have difficulty memorizing, the teacher might suggest alternatives to the rehearsal method for memorizing, using visual image mnemonic techniques such as Peg, Loci and Link. (See Marshak and Wittrock)

It would be unrealistic as well as undesirable, to match learners with teachers, based on their learning styles, *all the time*. Rather, we should encourage the "flexing" capabilities of both teachers and students. The process of having students gradually become more adept at adjusting learning style to teaching style and task has been labeled "learning-to-learn." Once students learn how to learn, they can transfer this ability

to all learning situations and become increasingly less dependent on a teacher. In teaching children how to learn, we must first give them information about their basic learning characteristics and make them aware that it is possible to teach oneself. In teaching children how to learn-to-learn through capitalizing on their learning proclivities and through style "flexing," we enable them to begin to feel more in control of their own destinies. This can lead to a better self-concept and a more positive life view. Bruce Joyce confirms the feasibility of the learning-to-learn concept in his research on Models of Teaching Assessability Characteristics. He found that

Children who vary quite a bit in conceptual level appear to be able to learn the processes of the different models of teaching so that they can achieve considerable levels of independence . . . [they] appear to be able to acquire a variety of strategies for teaching themselves in much the same manner that teachers can acquire a variety of methods for teaching.

It seems, however, that success in teaching the learning-to-learn process is highly dependent on making this goal clear to students and then exposing them to a variety of styles selected for their effectiveness in particular situations. There are few, if any, styles that work for every learning situation.

Implications of Brain Research for Learning Style Development

The human brain does not fill up. Everyone can learn one more thing. We have long been told that we never make use of the brain's capacity for learning. (Some estimates of our use of the brain's potential are as low as 10%). The research of the past decade is revealing just how the brain manages to have such an amazing capacity. Instead of filling up, it now appears that learning actually increases the capacity for more learning. The more one learns, the more one is capable of learning.

The brain is constantly growing and changing. But environmental stimulation and a wide range of experiences is critical for *optimum* brain growth and development. Education can actually physically alter the brain, but it takes time. (See Teyler and Epstein.) One example of the brain's plasticity comes from an experiment in which subjects who were taught the scientific method actually had more dendritic branches in their brains than those in the control group.

After 25 years of research, Reuven Feuerstein, a former pupil of Piaget, has constructed a theory of intelligence, which proposes that experiences that promote cognitive processes are those that are "mediated." The mediator (teacher) transforms or reorders an experience in the direction of some specifically intended goal and purpose. The specific content of the experience is unimportant, according to Feuerstein. What is crucial is the extent to which the experience provides insight into the thinking processes.

... too few mediated experiences result in poor thinking skills, which in turn reduce the individual's ability to learn from further direct experiences. . . . remedial efforts aimed at providing a stimulating environment (filling the rooms with posters, toys and colorful mobiles, as Feuerstein puts it) are not apt to be effective Neither stimulation (of the above sort) nor the acquisition of facts will, in themselves, improve retarded performers thinking skills

(Chance, 1981, 68)

Feuerstein's conclusions are not unlike those of Piaget and Kohlberg. They found that cognitive development was contingent upon having "higher level reasoning" presented to a person in order to create an *appropriate* level of tension or dissonance. Such dissonance can act as a motivator since people naturally seek order, or meaning. Of course, too much dissonance can be harmful just like too much of anything!

Proper timing is critical to learning since certain cognitive processes seem to be facilitated during particular brain growth stages; that is, children are capable of empathy very early since the region of the brain responsible for this process develops early. Herman Epstein's discovery of brain growth spurts between ages 2-4, 6-8, 10-12 and 14-16, with each followed by a plateau, suggests that there may be certain times that are best to teach certain cognitive processes. One hypothesis proposed by Epstein is that left-brain processes can be most efficiently learned during growth spurts and right-brain processes best acquired during plateaus.

The left-right hemispheric specialization of the brain is assumed to increase the efficiency of learning with each side offering alternative, but equally valid, ways of knowing. The more we can fully develop the faculties of each hemisphere, the greater will be the number of learning strategies available to learners of all styles. Patricia Fox proposes a "balanced" or integrated use of the hemispheres in teaching and learning through stimulation of the linguistic functions of each hemisphere: left deals with the syntactic, logical, ordered, denotative aspects of language; right processes the associative, connotative meanings of words and uses imagery and metaphor to "comprehend." Obviously, both types of thinking are needed for mature reading. Fox and Wittrock contend that left- and right-brain processes each make significant contributions to language comprehension. They report numerous studies

that show that teaching right-brain visual imagining can be a powerful means of increasing reading comprehension. This is not to imply that such techniques as rehearsal of vocabulary not be used, but that children should be taught to use both styles so that information can be processed, stored, and retrieved in more than one way.

Fox and Languis separately cite research supporting the practice of providing experiences to develop concepts prior to the teaching of actual vocabulary, since to learn a new word, the learner must already know the concept behind the word. The types of experiences they prefer are right-brain oriented activities of a visual-kinesthetic nature such as drama, art, and use of manipulatives and pictures. Examples of activities that develop concepts that can later be attached to printed words include having children pantomime verbs; create statues with their bodies to express such concepts as love, aggression, or boredom; and use facial expressions to convey emotions, such as anger, tiredness, surprise, delight.

Another aspect of brain research that cannot be ignored by teachers is gender differences in cognition. A few findings from Epstein's work provide examples of these differences. 1) Girls have been found to be inferior in visual-spatial tasks, such as map, chart and graph reading. 2) Girls often develop a left-hemisphere specialization at an earlier age than do boys. This suggests that they may be able to handle a more sophisticated reading curriculum than boys of the same age. It also helps us understand why there is a disproportionate number of young boys with reading problems (four-to-one ratio over girls) and suggests that with time and proper teaching these boys can become good readers. 3) Girls have a major growth spurt between ages 10-12, demonstrated by head growth twice that of boys the same age (reflecting brain enlargement). Between ages 14-16, boys experience this same head growth. Such gender differences obviously influence learning style. This information provides us with a new perspective for viewing the curriculum in which gender can be considered. The curriculum need not be the same for all students. As Estes and Vaughn put it, "Nothing is so unequal as the equal treatment of unequals."

The essence of learning lies in how the learner constructs meaning or makes sense out of stimuli. Wittrock reviewed a multitude of studies, in-

cluding his own, to support this concept. The now classic study in which split-brain patients generated a whole image, when a picture of half a face or half a rose was shown first to one eye and then the other, demonstrates how the brain fills in the gaps to create a whole image. Fortunately, students have both left *and* right hemispheres, each of which can attend to, organize, perceive, encode, store, and retrieve information in its own way. The degree to which such integrated processing happens, however, is often dependent on what the teacher does. And what a teacher does is dependent on what the teacher knows about how students learn. Following is a summary of instructional implications based on Wittrock's study of cognitive processes in the brain.

1. Teachers should activate and capitalize on students' past experiences which form the structure into which they can assimilate new learning. Children of all learning styles can benefit from set inducing activities such as brainstorming, word association, webbing, advanced organizers, fantasy journeys, or even simple pretests that provide students with a self-assessment of the degree to which they "know" key concepts. Such introductory activities should be chosen in terms of the kind of cognitive processing that the subsequent task will involve. For example, a pantomime is an introductory activity that primarily stimulates right-hemisphere processes and may be inappropriate if the subsequent task requires students to shift attention to an extremely verbal logical activity. However, if the purpose of an introductory activity is to create cognitive dissonance for a creative production, necessitating left- and right-brain processing, then an activity might be chosen deliberately to activate cognitive processes different from those that will follow in the lesson development. This attention shifting does occur in the brain, so it is necessary to use introductory activities that focus attention where it is needed in order to achieve instructional goals.

2. Teachers should remember that the same treatment may mean different things to different learners and different treatments may be needed to attain the same ends with certain learners. This implies that teachers should have a repertoire of teaching style strategies from which to draw. Strategy selection should be based on both content and skill objectives *and* the learning styles of the students.

3. Teacher expectations are critical factors in influencing student learning. Since ultimately the learner must perform the cognitive operations to construct meaning, the teacher needs to set expectations for active participation by students, such as assuming responsibility, relating past experiences to the task, and elaborating on, transforming, and organizing information. The teacher should make clear that mentally active participation is both expected and necessary in order for learning to occur. Increasing student involvement in and responsibility for new learning is consistent with the learning-to-learn idea mentioned previously.

What one knows is, in youth, of little moment;
They know enough who know how to learn.

Henry Brooks Adams

Once students know how to learn, they begin to feel more in control of their own lives. According to studies cited in Languis (1980), students' "locus on control" (one learning style aspect) correlates with increased academic performance and self-confidence.

4. Teachers need to reconsider the concepts of attention (as in "to get their attention") and motivation (as in "to get students motivated"). Brain research has shown that attention to and motivation for tasks are complex internal states highly dependent on the learner's plans, intentions, and past experiences. While it is possible to attract transitory attention by using surprise and novelty (e.g., flicking the lights, playing a chord on the piano, whispering), sustained attention and real mental engagement with a task requires that the students have a clear understanding and acceptance of the goals of the task. It is easy to make instructional goals clear to students (give them verbally, write them on the board, use study guides), but having students accept and want to work toward the goals is a bit more difficult. Providing a rationale for goals and giving examples of their relevancy are strategies that can be effective. Also giving students choices in goal selection helps them to learn how to structure their own learning. (See Hunt's research on conceptual level, 1974, 1971.)

Teachers could end up doing more harm than good if their use of the results of brain research for learning style development is simply to at-

tach another label to each child. A learner cannot be reduced to a dominant brain hemisphere or a cognitive process. One of the most important themes in learning style literature is that teachers and learners are interacting synergisms whose teaching and learning style must always be defined in terms of a particular set of circumstances. We are what we are in a context; and we cannot separate ourselves from the fields in which we are imbedded without losing an integral part of the whole that is each person. The instructional emphasis must always be on the thoughtful choice of strategies and activities, in light of the learner's style and the task demands.

Adapting Teaching Style to the Learning Situation

A person's ability to learn is specific to particular content or function. Learning style cuts across content and skill areas. Ability deals with *what* to learn. Style is concerned with *how* to learn. The "more is better" orientation of our society has influenced our concept of ability. We tend to believe that people either have or don't have the ability to learn, without considering the nature of the learning task or the potential of people of all abilities to learn in different ways.

One of the contributions of learning style research is to help educators realize that all people possess ways to learn despite their ability levels. When we consider the variety of learning styles people use, we realize that there is no right or wrong way to learn, but there are styles that are more appropriate for given situations. It is true in our society that reflective, abstract, sequential thinking seems to be favored for most kinds of school tasks as well as for many prestigious jobs; but we all possess latent learning styles that are not used until the situation demands them.

Earlier learning style was defined as a "consistent pattern of behavior but with a certain range of individual variability." To illustrate, a person's style may be generally characterized as close-minded, intolerant of ambiguity, and having a tendency to oversimplify. We can all think of both teachers and students who fit these descriptors. But style is both stable and flexible. Given the right circumstances, the individual described above can employ thinking processes that are generally associated with open-minded people who think a "right" answer is right only because it fits a particular situation. For example, a

teacher may be close-minded about religion but open-minded about politics, or vice-versa. As the context changes, the demands placed on a person change. To some degree, all people flex because of the situation. The amount of flexibility, however, depends largely on a person's repertoire of thinking processes.

If we have learned more strategies, then our styles have more range. But even with skill in using strategies, we must still know how to *select* the strategy appropriate for the situation. For example, we can't say that questioning for factual information (a teaching strategy) is bad or good when viewed in isolation. But if a teacher's purpose is to have students identify the themes from the story of "Three Little Pigs" and she asks such questions as "How many bricks did the third pig use?" or "What building materials did each pig use?" then we can judge the value of this literal questioning strategy within a specific context. The first question is ridiculous. Given the purpose of this lesson, the second question is clearly inappropriate. But do we throw out the strategy of literal level questioning, which may be very appropriate for achieving certain instructional objectives?

While teachers generally have an overall style, this does not mean that they cannot add to or modify that style as circumstances warrant. Bruce Joyce (1981) reports success in helping teachers with various teaching styles to learn new models of teaching behavior that contribute to student learning. An example is the use of "advanced organizers." When teachers use advanced organizers, they give students the overall structure of the material to be learned prior to the lesson development. An advanced organizer can be as simple as an anecdote or personal experience, which enables students to relate the material to their own past experiences. Once these past experiences are activated, they become the hooks on which new learning is hung. In learning how to use advanced organizers, teachers can widen the scope of their own learning styles as well as their teaching styles. Students can then learn from their teacher's use of advanced organizers and also learn how to create their own advanced organizers. The process has a ripple effect resulting in an increased repertoire of strategies for both teacher and learner styles.

Following are some suggestions for teaching strategies that recognize the varieties of learning styles.

1. Use questions of all types to stimulate various levels of thinking, from recalling factual information to drawing implications and making value judgments.

2. Provide a general overview of material to be learned, i.e., structured overviews, advanced organizers, etc., so that students' past experiences will be associated with the new ideas.

3. Allow sufficient time for information to be processed and then integrated using both the right- and left-brain hemispheres.

4. Expect that at least one new thing will be learned by each student. Begin the lesson by setting a purpose, "Be ready to share orally one new thing you've learned today." Go around the room at the end of the period or the school day and have each student tell something he or she has learned. Once this routine becomes established, students soon begin actively to seek a "new learning" during lessons because they know they are expected to share something.

5. Set clear purposes before any listening, viewing, or reading experience.

6. Warm up before the lesson development by using brainstorming, set induction, vocabulary pretest, word associations, fantasy journeys, etc.

7. Use spaced practice to facilitate remembering and skill development, and have the practice include both verbal and image rehearsal depending on the nature of the task. Some visual image mnemonic techniques are: Peg, Loci, Link. Verbal mnemonics include acronyms and acrostics. (See Marshak, 1979.)

8. Use multisensory means for both processing and retrieving information. Write directions on the board as well as give them orally. Have students write down instructions as well as read them.

9. Use a variety of review and reflection strategies to bring closure to learning. Some examples are writing summaries, writing creatively (stories, playlets, poetry), reciting, creating opinion surveys in which students respond to the main ideas in a unit, engaging in drama activities (role playing, improvisation, dramatizations).

10. Use descriptive feedback rather than simply praising, i.e., instead of "Good job" say "Each problem you worked so far is correct."

Ways to Assess Learning Styles

There are a variety of commercially published instruments to measure one or many aspects of learning style. Although some are time-consuming to administer (the *Mill Learning Methods Test* is administered over four days), others require only 15 minutes. Several require special training to administer and interpret (Myers-Briggs Type Indicator); others are informal instruments that can be used and interpreted without much preparation. There is really something for everyone: self-reports, paragraph completions, semantic differentials, recalled impressions, preference tests, observation guides, interviews, observation of actual tasks being performed, interest inventories, etc. You can rotate cubes, arrange geometric shapes, interpret jigsaw puzzle pieces, or discriminate shapes imbedded in busy backgrounds—all in the interest of finding out about learning style.

In selecting a learning style instrument, educators need to consider the validity, cost, time to administer, and ease of interpretation of the instrument and, most important, whether teachers can and will use the results it yields. If this last point is ignored, schools can end up with an expensive, elaborate, and time-consuming testing program that will never be used. Teachers already know much more than they are able to do, so the best instrument will be one that helps teachers organize what they already know in a way that they can readily implement in their teaching. Of course, children with serious learning pathologies need more thorough assessment. This is where the trained specialist using sophisticated instruments can offer a valuable service. Testing is a total waste of teachers' and students' time if the results cannot be used to improve learning.

Other important points need to be considered when assessing learning style. Remember that a learning style assessment gives information about the learner at a point in time. Also, there can be a great deal of difference between a person's reported learning preferences and the way the person actually learns best. This is especially true for children. For

example, you will often receive quite a different response when you ask "Where would you *like* to sit in the classroom?" than when you ask "Where *should* you sit to learn *best*?" There is a difference between preference and performance; while there is overlap between the two, teachers should not yield to preference when it doesn't facilitate performance.

Even without formal instruments, it is possible to obtain assessment information from observations of students (the author's informal instrument on pages 15-18 can serve as a guide for what to look for). Or you can discuss with students their own views by simply asking "How, when, where and what do you learn best?" Another technique for obtaining information about students' learning styles and at the same time teaching them about style flexibility is to have them write or tell about a learning or study situation, in which they were either productive or non-productive. Following is a sample situation:

Charles waited until the last minute to study for his spelling test. He knew he should have spaced out his study over the week, but he had procrastinated. Now there was little time left to write the words several times, which was the way he usually learned to spell words. So he tried just to practice spelling them out loud. The next day he missed nearly all the words on the test.

By asking the students to analyze the situation, they will be able to describe Charles's learning style, what he did wrong, and what he should do the next time. To personalize the discussion, have the students discuss how they are like or different from Charles. Students profit from discussing such situations. Over time, they begin to discover that each person learns somewhat differently but also shares learning style characteristics with others. Personal learning style situations generated by students in the class can become a relevant and practical problem-solving exercise. It is amazing how much even elementary school children know about their own learning processes and how much they can teach each other if situation discussions become a regular weekly part of classes. To keep track of conclusions students draw from such discussions, develop a class chart of "Learning Tricks," to which strategies can be added as new situations arise.

Results from formal learning style instruments should be considered informed speculations and not the final word. They can serve as points of departure for in-depth student/teacher/parent dialogues, but Leonard Davidman warns that such instruments may give teachers a "false sense of knowing." He recommends that teachers follow up formal testing with probing questions, teacher observations, verbal and nonverbal feedback, short teacher-made questionnaires, student autobiographies, individual conferences, etc.

A selected bibliography of the available instruments for assessing various aspects of learning styles follows.

Selected Bibliography of Learning Style Assessment Instruments

Multidimensional Instruments

Child Rating Form by Manuel Ramirez and Alfred Castaneda. In *Cultural Democracy, Biocognitive Development, and Education*. New York: Academic Press, 1974.

A direct observation checklist yielding frequency of behavior based on field independence/sensitivity and cultural differences. Teacher rates younger students; older students can rate themselves. Administration time varies. A revised version will soon appear in *New Frontiers* to be published by Pergamon Press, Inc.

Cognitive Style Interest Inventory by Joseph Hill. In *Personalized Education Programs Utilizing Cognitive Style Mapping*. Bloomfield Hills, Mich.: Oakland Community College, 1971.

A self-report instrument based on a rank ordering that measures abstractions; visual, tactile, and auditory perceptions; motor coordination; and social interaction. Can be used with elementary students and up. Takes approximately 50 minutes.

Learning Style Identification Scale by Paul Malcom, William Lutz, Mary Gerken, and Gary Hoeltke. Publishers Test Service (ETB/McGraw-Hill), 2500 Garden Road, Monterey, Calif. 93940, 1981.

A short, (24-item) self-scored rating scale based on the concept of learning style as the "method students use to solve any problem that they encounter in their educational experiences." Five styles are identified based on classification of information reception and use, cognitive development, and self-concept.

Learning Styles Inventory by Joseph Renzulli and Linda Smith. Mansfield Center, Conn.: Creative Learning Press, 1978.

Both teacher and student forms are available for this 65-item instrument designed to measure attitude toward nine modes of instruction. Students and teachers indicate their reactions using a Likert scale ranging from very unpleasant to very pleasant. Forms are on optical scanning sheets and are scored by computer. Requires 30 minutes to administer and can be used in grades 4 through 12.

Learning Style Inventory (students, 1978) and *Productivity Environmental Preference Survey* (adults, 1977) by Rita Dunn, Kenneth Dunn, and Gary E. Price. Price Systems, Box 3271, Lawrence, Kans. 66044.

Self-report questionnaires yielding information about how a given student learns. There are 36 subscales covering 18 elements in four areas: Environmental, Emotional, Sociological, and Physical. It is computer scored.

Learning Style Inventory: Primary Version by Janet Perrin. Jamaica, New York: St. John's University, 1981.

Based on the *Learning Style Inventory* of Dunn, Dunn, and Price and designed for young children. The questionnaire consists of 12 charts, each containing a series of pictures and questions that assess a different element of learning style. The inventory is individually administered and scored on a student profile form. Takes about 20 minutes.

Learning Styles Inventory by Albert A. Canfield and Judith S. Canfield. Humanities Media, (Liberty-Drawer) 7970, Ann Arbor, Mich. 48107, 1976.

Self-report instrument based on a rank ordering of choices for each of 30 questions. For use with junior high and up. Takes about 15 minutes.

Myers-Briggs Type Indicator by Isabel Briggs Myers and Katherine C. Briggs. Consulting Psychologists Press, Inc., 577 College Avenue, Palo Alto, Calif. 94306, 1976.

A measure of personality dispositions and interests based on Jung's theory of types. Suitable for early adolescents through adults. Provides four bipolar scales that can be reported as continuous scores or reduced to types. Requires special training to administer.

Short Inventory of Approaches to Studying by Noel Entwistle. In *Styles of Learning and Teaching*. New York: John Wiley and Sons, 1981.

A 30-item test, using a Likert scale, in which students respond to statements concerning their achieving orientation, reproducing orientation, meaning dimension, comprehension style, operation style, and versatile approach. An index of learning pathologies can be obtained by summing three subscales. There is also a prediction of success score. Takes about 30 minutes. Appropriate for junior high and up.

Student Learning Styles Questionnaire by Anthony F. Grasha and Sheryl W. Riechmann. Institute for Research and Training in Higher Education, University of Cincinnati, Cincinnati, Ohio 45221, 1974.

A hand-scored, self-report inventory of 90 items designed to elicit student attitudes toward the courses taken in college or high school and to identify related learning style. Six styles are described: Independent, Avoidant, Collaborative, Dependent, Competitive, and Participant.

Cognitive Style Instruments

Cognitive Profiles by Charles A. Letteri. In *Cognitive Profile: Basic Determinant of Academic Achievement*. Burlington, Vt.: Center for Cognitive Studies, 1980.

Seven tests of cognitive style that, in combination, predict student achievement level as measured by standardized achievement test scores. The seven dimensions are: 1) Field Independence/Dependence, 2) Scanning/Focusing, 3) Breadth of Categorization, 4) Cognitive Complexity/Simplicity, 5) Reflectiveness/Impulsiveness, 6) Leveling/Sharpening, and 7) Tolerant/Intolerant.

Concrete-Operational Reasoning Test and Logical Reasoning Test. In Robert Sund. *Piaget for Educators*. Columbus, Ohio: Charles E. Merrill, 1976.

Two paper-and-pencil, group-administered tests to reveal formal or concrete operational reasoning. The problems are multiple choice.

Group Embedded Figures Test (also Embedded Figures Test and Children's Embedded Figures Test) by Herman A. Witkin et al. Consulting Psychologists Press Inc., 577 College Ave., Palo Alto, Calif. 94306, 1971.

EFT was originally designed for research with the field independent-field dependent aspect of cognitive style and was used to assess analytic ability, social behavior, body concepts, etc. The GEFT is a group version of the test. Field independence and dependence characterize analytical vs. global styles of information processing. The latter test takes about 15 minutes.

Inventory of Learning Processes by Ronald R. Schmeck, Fred Ribich, and Nerella Ramanaiah. In "Development of a Self-Report Inventory for Assessing Individual Differences in Learning Processes," *Applied Psychological Measurement* 1 (1977):413-31.

A 62-item, true-false, self-report inventory grouped by factor analysis into synthesis/analysis, study methods, fact retention, and elaborative processing, reflecting a continuum of student information processing preferences from deep and elaborative to shallow and repetitive. Approximate administration time is 20 minutes.

Learning Strategies Questionnaire by Norman Kagan and David R. Krathwohl. In *Studies in Human Interaction*, Washington, D.C.: HEW/USOE Bureau of Research, 1967.

A short self-report questionnaire developed for use at the college level to describe learner strategies that either focus on the details of a learning situation (focusers) or attempt to piece together the larger picture (scanners), on a continuum of discrete to global orientation. A scanning strategy is related to field independence and to academic success.

Learning Style Inventory by David Kolb. In "Disciplinary Inquiry Norms and Student Learning Styles: Diverse Pathways for Growth." In *The Modern American College*, edited by Arthur Chickering. San Francisco: Jossey-Bass, 1981.

A 5- to 10-minute self-report based on a rank ordering of four words in each of nine different sets. Each word represents one of four learning modes: feeling (Concrete Experience), watching (Reflective Observation), thinking (Abstract Conceptualization) and doing (Active Experimentation). For use with upper-grade students. Administration time is approximately 10 minutes.

Matching Familiar Figures Test by Jerome Kagan. In "Impulsive and Reflective Children." In J. Krumboltz. *Learning and the Educational Process*. Chicago: Rand McNally, 1965.

MFFT assesses individual differences in the speed and adequacy of information processing and concept formation on a continuum of reflective to impulsive. The testee is shown 12 pictures and, in each case, six similar alternatives, only one of which is correct. Reflectives tend to take longer and to produce more correct solutions than impulsives.

Schematizing Test by R. W. Gardner et al. In "Cognitive Control: A Study of Individual Consistencies in Cognitive Behavior." *Psychological Issues* 1 (4) (1959).

Assesses individual variations in memory processing on a continuum of leveling to sharpening. Each subject is asked to judge in inches the sizes of 150 squares successively projected on a screen. The squares range in size from 1 to 14 inches on a side and are shown in a prescribed order. Levelers are likely to over-generalize, while sharpeners may over-discriminate.

Transaction Ability Inventory by Anthony F. Gregorc. Department of Secondary Education, University of Connecticut, Box U-33, Storrs, Conn. 06268.

A self-report instrument based on a rank ordering of four words in each of 10 sets revealing four combinations of learning preference dualities: 1) Abstract Sequential, 2) Abstract Random, 3) Concrete Sequential, and 4) Concrete Random. Observation and interviews are suggested as adjuncts to the instrument. Administration time is approximately five minutes. Can be used with junior high students and up.

Your Style of Learning and Thinking, Forms A & B by E. Paul Torrance, Cecil R. Reynolds, T. R. Riegel, and O. E. Ball. *Gifted Child Quarterly* 2 (1977):563-573.

A 36-item, self-report, multiple-choice questionnaire that classifies subjects according to right hemisphere, left hemisphere, and integrated information processing. Each item presents three choices for the three modes based on an analysis of the research on brain hemispheric functioning. Approximate administration time is 20 minutes. Can be used with upper-grade students and adults.

Affective Style Instruments

Intellectual Achievement Responsibility Questionnaire by V. C. Crandall, W. Katkovsky and V. J. Crandall. In "Children's Belief in Their Own Control of Reinforcements in Intellectual-Academic Achievement Situations," *Child Development* 36 (1965):91-109.

The IAR scale is designed to assess internal-external perceptions of the control one exerts specifically in intellectual and academic situations. There are elementary and secondary school versions of the questionnaire.

Student Motivation Information Form by Raymond J. Wlodkowski. University of Wisconsin, Milwaukee, 1978. (Available from NEA.)

A 35-item, incomplete sentences test that elicits information about what motivates the person, e.g., intrinsic or extrinsic rewards. Could be administered orally to younger children.

Paragraph Completion Method by David E. Hunt et al. In *Assessing Conceptual Level by the Paragraph Completion Method*. Ontario Institute for Studies in Education, 252 Bloor Street, West, Toronto, Ont. M5S 1V6, 1978.

A semi-projective method to assess the degree of classroom structure needed by students. Conceptual level shown by completing six incomplete statements involving conflict or uncertainty. (1. What I think about rules . . . , 2. When I am criticized . . . , 3. What I think about parents . . . , 4. When someone does not agree with me . . . , 5. When I am not sure . . . , 6. When I am told what to do . . .). Special training required to administer.

People in Society (Internal/External) Scale by Julian B. Rotter. In "Generalized Expectations for Internal Versus External Control of Reinforcements." *Psychological Issues* 1 (4) (1959):11-12.

A questionnaire to find out how people react to certain important events that they experience in their society. Measures the degree of control persons feel over their world.

Perceptual Modality Instruments

Swassing-Barbe Modality Index by Walter Barbe and Raymond Swassing. Columbus, Ohio: Zaner-Bloser, 1979.

This is a series of three tasks involving visual, auditory, and kinesthetic-tactile processing of the order of geometric shapes. It can be used with learners of any age but must be individually administered. Results tell the percentage of the time each mode is used successfully. Kit includes a textbook on modality instruction and a filmstrip and tape.

Swassing-Barbe Checklist of Observable Modality Strength Characteristics

This is a one-page brochure for use by teachers as they recall student characteristics. Columbus, Ohio: Zaner-Bloser.

"Find Your Modality Strengths" by Walter Barbe. In *Instructor* (January 1980), 1980).

This is a series of 10 incomplete sentences that are supposed to give "a rough idea of the relative strength of each of your modalities." Can be used by teachers and older students.

Learning Methods Test by Robert Mills. Available from The Mills School, 1512 E. Broward Blvd., Ft. Lauderdale, Fla. 1955.

The LMT determines the "students' abilities to learn new words under different teaching procedures." The tasks involve visual, kinesthetic, phonic, and combination presentations of words. Since immediate and delayed recall is assessed, the test takes four days, 15 minutes each day. It is individually administered.

Edmonds Learning Style Identification Exercise by Harry Reinert. In "One Picture Is Worth A Thousand Words? Not Necessarily! *The Modern Language Journal* 60 (1976):160-68.

ELSIE provides a profile of students' preferred perceptual styles based on patterns of responses to 50 common English words. Four general categories are defined: Visualization, Written Word (reading), Listening, and Activity (kinesthetic).

SRI Student Perceiver Interview Guide. Selection Research, Incorporated, 2546 South 48th Plaza, P.O. Box 6438, Lincoln, Neb. 68506, 1978.

A structured interview process designed to elicit student perceptions grouped under 16 themes that are predominantly affective in nature. Institutions leading to trained certification are held regularly in designated cities. Administration time is approximately 45 minutes. Can be used with intermediate students and up.

Matching Teaching Styles with Learning Styles

Matching seems to be important in our world. We like our socks to match; we prize matched pairs of horses; and making the right match with a mate is one of life's most important tasks. Matching teaching styles and learning styles also would seem desirable, but it is not an easy feat.

The matching dilemma becomes a challenge when we consider the multiplicity of ways it can be done: teacher's overall style to students' overall styles; level of task difficulty to students' abilities; form of presentation to students' cognitive, affective, and psychological styles; sequence, scope, quantity, structure, schedule of repetitions, pace, goals, etc., to each student's corresponding learning style aspect. The list is endless. We can envision a network of matches that even the most sophisticated computer could not handle. Matching seems much like getting a broken zipper back together again; just as you get the two teeth lined up in front of the tab, those behind it pop out.

The value of using matching as the most effective means of maximizing individual development and creativity is debatable. Optimal learning conditions vary with the goals of the educational situation and obstacles, opposition, contradiction, and conflict are necessary to stimulate flexible and creative thinking. Since flexible and creative thinking are vital in today's world, development of this type of thinking becomes an overriding educational goal. So we must look askance at the "perfect match" as the means to such an end.

Perhaps we need to look beyond the *sequential* processing capabilities of both human beings and computer to the *simultaneous* creative processes housed in the right hemisphere of every teacher.

Somewhere, at this very moment, a teacher is spontaneously adapting instruction and materials to the manifold style differences among students in his or her classroom. Good teachers have always adapted their teaching style by using humor, changing tempo, varying the frequency and type of reinforcement, and capitalizing on student interests—even as the lesson progresses. Presumably, the more teachers know about various style elements, the better able they will be to make these adaptations consciously. Often, such style adaptations require little time and no materials. For example, when a teacher senses a general feeling of anxiety about an assignment among students, she might joke with them or reassure them by giving additional instructions or examples. In doing so, the teacher has brought teaching style more in line with the learning styles of some of the students.

"Style matching," "style flexing," "capitalizing," "compensating"—whatever label is used—is often a natural response to the mismatch teachers sense between the task demands and the students' styles and abilities. Teachers can rely on their intuition, supplemented with knowledge of style aspects, so that when problems arise, prescriptions can be developed instantaneously. And if the first one doesn't work, there are many others to use. (We would hope that as students mature, *their* styles would have a greater range; and then they could do their share of the style flexing.) Although teachers can anticipate style differences and prepare for them in advance of lessons by developing alternative assignments, by using multisensory presentation modes, by arranging for some degree of student choice and planning, and by using different types and degrees of reinforcement, much of the style matching will need to be done *during the lesson*. David Hunt even goes so far as to say that "The best teaching approach in a situation cannot be specified in advance since its central feature lies in its flexibility."

If we accept Madeline Hunter's definition of teaching as "the process of making and implementing decisions, before, during, and after instruction, to increase the probability of learning," then a matching mechanism is already in place in every classroom. Such a perspective respects the innate and acquired capabilities of the teacher and focuses on flexible teaching style as the means of increasing style ranges among students. It has worked from the time of Socrates and can continue to

work if we believe that the teacher is the greatest learning resource a child can ever have.

Sadly, there are students who, if asked to name their favorite teacher, would answer "Atari" or "TRS-80." Should we be surprised at their answers when educators, themselves, turn to hardware and software to solve learning problems? The source of teaching is no more outside the teacher than the source of learning is outside the learner. Fortunately, faith in the teacher's intuitive sense to match styles is expressed by some, such as David Hunt, who has observed that:

1) When teachers express their concepts of their students, they use almost every individual difference, learning style, or accessibility characteristic that researchers and psychologists have proposed; 2) many teachers are already using every matching model proposed by research; and 3) many teachers express their implicit matching models in terms more easily understood by other teachers than those of researchers.

Or as Leonard Davidman wisely states it: "Schools exist to serve both society and individual; striking the proper balance is not a job for a computer, a 104-item questionnaire, or a 10-year-old child." But it is the job of the educator to draw instructional implications from the research on style matching. In other words, whenever we consider matching as a means of increasing learning, the question must be asked, "Matching for what?" A few research results will illustrate the importance of this point.

1. Teaching and learning style matches have been found to increase satisfaction and mutual regard among teachers and learners. (See Kirby, Hunt, and Cotterell.) In fact, there is strong support for matching as many cognitive, affective, and physiological teacher and student style variables as possible, if the goal is to improve student attitudes and feelings of comfort with learning. Gregorc reports that mismatch can be a detriment to affective style aspects, producing anger, avoidance behaviors, procrastination, and even major emotional problems.

2. Warren noted a relationship between a teacher's field-dependent style and comfort with student-centered instructional approaches.

3. Matching children and teachers on field dependence was found to be unrelated to achievement test gains (Saracho and Dayton).

4. Of the 23 studies reviewed on matching for achievement outcomes, seven failed to establish matching relations while 16 showed only moderate support for the matching principle (Cotterell). These study results are representative of a larger body of research literature that seems to conclude that style matching can be strongly supported for affective reasons, but overall style matching produces inconsistent achievement outcomes. Perhaps the success of style matching in affecting attitude, attention, motivation, and general comfort can be accounted for by realizing that matching makes life easier. But easier is not necessarily better, and educators do not have the luxury of focusing only on affective goals of education.

The research picture about matching for achievement gains is more positive if, instead of trying to make multidimensional style matches, we match teacher and student *cognitive* style aspects or purposely mismatch them for particular reasons. For example, if the objective is to make impulsive children more reflective, they can be placed with a reflective teacher (Yando and Kagan). But remember, when we match or mismatch for one variable, other style variables may not line up as we would desire. So, while we work on helping impulsive children to be reflective (a cognitive aspect) by placing them with reflective teachers, we may be creating negative affective responses in students. Just imagine trying to slow down impulsive children and trying to help them approach tasks deliberately and carefully so that accuracy is increased. It can be done, given time and patience, but it can be frustrating for both teachers and students. So we're back to our earlier consideration: Matching for *what*? And if we know the *what* (goal), we must then decide if the effort to reach it is worth the trouble. If the answer is yes, then we must do whatever is necessary to help children reach the goal.

In summary, the question shouldn't really be *whether* or not to match teacher, student, and task style. A better set of questions is WHY, WHO, WHAT, WHERE, WHEN and HOW to match.

The WHY match question should lead educators to think about the goals of style matching (to improve attitude, to decrease anxiety, to strengthen a particular cognitive style such as abstract thinking, which in turn should make a student able to achieve on logical tasks). The

WHO question deals with people. Should a teacher who has the particular style a child needs be matched with that child, or does the child need exposure to a different style model in order to learn to use an alternative way of thinking, perceiving, or feeling? Can students be style matched or mismatched with peers to achieve the goals in instruction? The WHAT question should cause us to think about the particular style aspects within the cognitive, affective, and physiological domains that can be or should be matched or mismatched. Obviously, even during a single lesson, all style aspects can never be matched because the teacher, the student, and the task all possess different style profiles. So we must decide what the most critical style aspects are, given the lesson goals. This calls for a judgment, and sometimes we'll call it wrong; but fortunately, unlike computers, teachers and students have an infinite capacity for flexing to the situation; and they get better at it if they believe in that capacity, trust their judgment, and practice style flexing. The last three questions: WHERE, WHEN and HOW can be grouped together, because when we try to figure out how to match, we must consider when and where (and really who, what, and why, too!).

So, we are at another decision point. Should we match certain student and task style aspects? Holland reviews studies that found it advantageous to learn and be tested in the same modality. Hunt reports that high conceptual learners perform better on essay tests, while low conceptual students favor objective exams. Should we match between overall student and teacher style or just between a few critical style elements? What about the match between the task style and the teacher's style? For example, elementary teachers who tend to be field-dependent still must teach math, which, as a discipline, is rather impersonal, very logical, and demands careful deliberate thinking. The answers to WHO, WHAT, WHEN, WHERE, HOW and WHY questions of matching require decisions that only educators can make and implement. There are no right answers, but only right questions, with tentative answers, which are validated during the teaching and learning of a lesson.

Learning to Style-Flex

The first step in increasing the range of styles in your teaching repertoire is to *want* to change and to *believe* that it is possible. "Style-flexing," "augmenting one's map," "increasing the options," "becoming be-cognitive," "switch-hitting," "using both sides of your brain," and "stretching" are a few of the terms presently being used to describe how to increase the strategies in one's style repertoire. Basically, it boils down to being eclectic, not just for the sake of variety (although that is not a bad reason in itself) but because people and tasks demand different styles. Furthermore, by using variety, teachers provide a model of flexibility for students. In effect, each teaching strategy has a parallel student learning strategy that students acquire over time. Through strategies of learning-to-learn, students will acquire lifelong habits of teaching themselves.

Style-Flex Strategies

Following are strategies to use in teaching as the situation warrants. Remember, nothing works all the time; the success of a strategy is highly dependent on how, when, where, why and by whom it is used:

1. Present concepts and skills in a logical sequence, i.e., concrete to abstract, easy to difficult.
2. Let students know that you expect them to succeed.
3. Use specific examples and concrete models to make abstractions and generalizations clear.

4. Plan tasks within a student's range of challenge, i.e., some success guaranteed for everyone. (This implies that the teacher knows what prerequisite skills and concepts a task assumes and what skills and concepts students possess.)

5. Match learning tasks to students' developmental levels, i.e., à la Piaget, Kohlberg.

6. Reinforce desired behaviors, i.e., speaking in sentences, legible handwriting, completing tasks, original answers.

7. Give honest descriptive feedback to students about their performance as soon as possible.

8. Relate students' past experiences to new learning, i.e., tie in known with unknown (e.g., word associations, brainstorming, SQ3R, advanced organizers).

9. Give students various kinds of practice experiences, i.e., repetition, overlearning, and mastery learning.

10. Use all modes (visual, auditory, tactile, and kinesthetic) when teaching concepts and skills.

11. Clearly communicate to students the objectives of a task so they can understand its relevancy.

12. Give students opportunities to make choices and provide input about their own learning.

13. Use a variety of teaching strategies and change pace as appropriate.

14. Involve students actively in a lesson by using appropriate amounts of teacher talk and student talk/thinking, silent and wait time, empathy roles, drama.

15. Capitalize on student interests; structure learning centers around interests rather than just teaching skills in isolation.

16. Act as a model (listening, reading, speaking, writing, and especially THINKING!); demonstrate and practice what you preach.

17. Ask open-ended questions at all levels of Bloom's taxonomy.

18. Pre-teach key vocabulary presented in reading assignments.

19. Prepare students for learning by using such introductory techniques as fantasy journeys, warm-ups, attention getters, and novelty.

20. Structure and organize lessons with clear concise directions, explanations, focus questions, etc.

21. Provide students opportunities to pursue interest areas and receive credit for independent study.

22. Teach students to self-evaluate and reflect on their learning. Routinely ask, "What's one new thing you learned today?" Have students record progress on graphs, charts, etc

23. Capitalize upon teachable moments when interest and readiness to learn is at a peak.

24. Integrate the teaching of skills and content in unit teaching.

25. Ask students to paraphrase or retell main points of a reading or listening experience.

26. Follow direct teaching with practice or reinforcement activities.

27. Balance right-brain activities with left-brain activities.

28. Teach to students' strengths while remedying weaknesses; we all like to do what we do well.

29. Set appropriate pace for learning.

Can teachers who already have well-established teaching styles learn to style-flex? Yes, says Bruce Joyce (1981), a leading researcher in the field of teaching and learning styles. He suggests the following procedures as an effective way to help teachers incorporate new strategies into their repertoires. Provide teachers with:

1. An overview and description of the new model or style, including the theory and rationale supporting it

2. A demonstration of the model or style (in person or on videotape).

3. Practice using the model in simulated or classroom settings.

4. An open-ended feedback about performance, emphasizing self-evaluation and goal setting.

5. In-class assistance in the form of direct coaching.

(Joyce and Showers, 1980)

If the above steps look familiar, they should, because they are the same steps used in "direct teaching," which have been shown to be highly successful in increasing students' performances (see Bennett, 1976; Peterson, 1979; Good, 1979; Brophy, 1979). In the final analysis, teachers learn in much the same way as students.

Conclusion

All teachers and students possess the ultimate learning center: the brain. Each of its approximately 12 billion neurons has up to 5,000 synapses, making the possible number of interconnections in the brain so enormous that it is beyond our comprehension. As Shakespeare said, "We know what we are, but not what we may become." Our potential for "becoming" is unlimited. Research in learning and teaching styles helps us to understand the complexity of learning and to appreciate the role teachers play in the learning process. Somewhere, right now, a teacher is helping a student learn by doing something as simple as substituting a synonym for an unfamiliar word or relating a story to a learner's past experiences. Such simple strategies are just two among dozens that are

... inexpensive, easy-to-learn classroom techniques. Unlike teaching machines, they are easy to construct, transport and change. They need little maintenance, never rust and usually last as long as you need them. Their supply is infinite, and they cannot be consumed. The more of them you try to give away, the more of them you have. But there's one catch: You have to generate them yourself.

(Wittrock, 1978)

But the teacher is only a "bridge," and as Shel Silverstein reminds students, "This bridge will only take you halfway there—the last few steps you'll have to take alone."

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